AMENDMENTS TO THE CLAIMS

1. (Currently Amended) A method of fabricating trench isolation structures between integrated electrical devices in a semiconductor substrate, comprising:

placing a semiconductor substrate in a reaction chamber, the semiconductor substrate comprising trenches; and

completely filling the trenches with insulating material by atomic layer deposition, comprising a plurality of primary cycles, each primary cycle comprising, in sequence:

introducing a first vapor-phase reactant to the substrate, thereby forming no more than about one monolayer of a first reactant species conforming at least to surfaces of the trenches;

removing excess first vapor-phase reactant and byproduct from the reaction chamber;

introducing a second vapor-phase reactant to the substrate, thereby reacting with the first reactant species conforming at least to the surfaces of the trenches; and

removing excess second vapor-phase reactant and byproduct from the reaction chamber.

2. (WITHDRAWN).

3. (WITHDRAWN).

4. (WITHDRAWN).

5. (WITHDRAWN).

6. (Original) The method of Claim 1, wherein filling the trenches further comprises a plurality of secondary cycles, each secondary cycle comprising, in sequence:

introducing a third vapor-phase reactant to the substrate, thereby forming no more than about one monolayer of a third reactant species conforming at least to surfaces of the trenches, the third reactant species being different from the first reactant species;

removing excess third vapor-phase reactant and byproduct from the reaction chamber;

introducing a fourth vapor-phase reactant to the substrate, thereby reacting with the third reactant species conforming at least to the surfaces of the trenches; and

removing excess fourth vapor-phase reactant and byproduct from the reaction chamber.

7. (Original) The method of Claim 6, wherein the first vapor-phase reactant comprises a silicon source gas, the third vapor-phase reactant comprises an aluminum source gas and the second and fourth vapor-phase reactants comprise oxidant source gases.

8. (Original) The method of Claim 7, wherein the aluminum source gas comprises alkyl aluminum compounds and the oxidant source gas comprises water.

9. (Original) The method of Claim 7, wherein filling the trench consists of mixing the primary cycle and secondary cycle in a primary cycle to secondary cycle ratio between about 20:1 and 1:10.

10. (Original) The method of Claim 6, wherein the primary cycles deposit a first oxide species and the secondary cycles deposit a second oxide species.

11. (Original) The method of Claim 10, wherein the first oxide species is silicon oxide and the second oxide species is a metal oxide.

12. (Original) The method of Claim 11, wherein the second oxide species is aluminum oxide.

13. (Original) The method of Claim 12, wherein filling the trench comprises depositing between about 23% and 37% aluminum oxide by weight in silicon oxide.

14. (Original) The method of Claim 12, wherein filling the trench comprises depositing between about 26% and 34% aluminum oxide by weight in silicon oxide

15. (Original) The method of Claim 10, wherein at least a portion of the first and second oxide species combine to form a separate phase in equilibrium with a portion of the first oxide.

16. (Original) The method of Claim 15, wherein the separate phase comprises mullite, the first oxide comprises silicon oxide and the second oxide comprises aluminum oxide.

17. (Original) The method of Claim 16, wherein the insulating material comprises between about 25% mullite and 50% mullite by weight.

18. (Original) The method of Claim 10, wherein the primary and secondary cycles are mixed in a ratio to match a coefficient of thermal expansion (CTE) of the insulating material to within about 20% of a CTE of the semiconductor substrate.

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19. (Original) The method of Claim 18, wherein the primary and secondary cycles are mixed in a ratio to match a coefficient of thermal expansion (CTE) of the insulating material to within about 10% of a CTE of the semiconductor substrate.